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Suppression of Tuberculosis in Cattle

AND

Dr. von Behring's Immunization Methods.

Lecture Delivered at the General Meeting of the Veterinarians' Association of the County of Starkenburg, Germany, October 31, 1903.

BY

Dr. Lorenz, Obermedizinalrat.

There is hardly a disease regarding which the opinions of eminent veterinarians and physicians have changed so often and within such short intervals, as to the causes and methods of suppressing tuberculosis in man and cattle.

Bovine tuberculosis, also called "Perlsucht," was until 1782 supposed to be syphilis and known as "French Disease" (Franzosen Krankheit). In the same year, County Physician Heym in Spandau refuted the syphilitic nature of tuberculosis. This was the cause that the previous interdictions, to use the meat of the diseased animals for food, were annulled.

Up to the seventies of the last century, "Perlsucht" was looked upon as a specific disease of cattle only, which had nothing to do with man. Many thought that the little nodules of this disease represented sarcomata. The general opinion concerning the etiology was, that "Perlsucht" was a hereditary disease of cattle. This opinion was prevalent also regarding consumption (phthisis) of man, and expressed by Gerlach in his book on "Meat-Diet of Man." The food-laws of those times show clearly that meat of tuberculous cattle was not considered injurious to man, when the consuming of highly tuberculous meat was forbidden simply as "loathsome food."

Gerlach, in his above-mentioned book, favored the destruction of all tubercular cattle, not because of the danger to man, neither

to render the sick animals innocuous to other cattle, but to prevent infection of the offsprings. He, therefore, demanded the exclusion of all infected animals from breeding. Gerlach defended his theory and wanted it to become a law, in order to exterminate the disease, so that dairymen and farmers would not be permitted to bring infected cattle to the slaughtering houses. But notwithstanding the great influence enjoyed by Gerlach, his efforts were not successful and therefore the "Perlsucht" spread very rapidly.

In 1882 the tubercle bacillus was discovered by Prof. Koch, and shortly after it was demonstrated that "Perlsucht" and tuberculosis had the same generator; 15 years later, Prof. Koch was doubtful as to the identity of the bacillus of human and cattle tuberculosis, and this at a time when preparations were being made to introduce a law for the inspection of meat of all slaughtered cattle.

Prof. von Behring, in his last lecture at Cassel refuted this doubt most emphatically, and I believe the majority of veterinarians and physicians agree with him.

Koch's doubt regarding the identity of human and bovine tuberculosis was caused by the difficulty of transmitting human tuberculosis into the bovine species. I must admit, that I consider it a lack in research work, that it took 15 years to decide this above-stated difficulty. It is well known that certain germs after having passed through a certain species of animal will lose their virulence for some species, while for others again it will prove to be still more violent.

It has not as yet been demonstrated, whether tubercle bacilli, taken from man and showing only slight virulence in the bovine species, will not gain in strength after having passed through a larger number of cattle.

It would be going too far, to mention all the different methods, that have been tried and proposed, in order to check the spreading of bovine tuberculosis. None of them has proved successful.

but there were a few which promised good success. One of the most prominent methods was based principally upon the use of tuberculin which was first discovered by Koch in 1890.

The results reported in Congress and medical societies led to a circular note regarding the immense number of tuberculous cattle and the way to suppress tuberculosis. In this circular letter the following points were taken into consideration:

1. The reporting to the Board of Health of all cases of slaughtered cattle which had been found tuberculous.
2. To empower the Board of Health to condemn and destroy the meat of infected animals.
3. The reporting of infected animals by the officials of slaughter houses to the authorities of the respective raising and breeding places. These authorities to take preventative measures, to examine the animals alive, to destroy the reacting, to isolate the non-reacting ones, and to order stable disinfection, etc., etc.
4. The allowance by the Government of an indemnification for each condemned animal.

The application of Prof. Koch's tuberculin as a therapeutic and its use as a diagnostic are fully known. The results obtained from the testing of cattle were very depressive for dairymen and cattle breeders. They proved that the majority of cattle and even whole herds were affected. It was impossible to destroy all infected animals on account of the pecuniary sacrifices, not to speak of the agricultural disadvantages which would follow. For these reasons it was not thought advisable in Germany to adopt the means of suppressing tuberculosis with tuberculin.

In Denmark they succeeded in introducing the so-called Tuberculin-Law in 1893, due to the energetic endeavors of Prof. Bang.

The Danish Government subscribed yearly 50,000 kronen, in order to make the tuberculin-test free of charge to those owners of cattle who guaranteed to isolate the healthy from the reacting

27475

animals and to gradually dispose of the infected cattle. There was not the least opposition on the part of the cattle breeders and dairymen to this mode of proceeding. We know that Denmark has a considerable over-production of cattle, and therefore a large export. The country could, therefore, only gain, but not lose by following this method, even if it was very expensive at the start.

Bang's method was also tried in several states in Würtemberg, but without success, notwithstanding the fact, that every precaution was taken. All non-reacting animals were isolated, but—after a certain length of time—reacted when again tested with tuberculin.

February 1st, 1894, a motion was made in the "Landtag" (Prussian Parliament) by von Tiedemann, to introduce a law for the suppression of tuberculosis, the disease doing most damage to agriculture. He proposed:

"To make it a law to report all cases of infected cattle and the indemnification for the destroyed animals."

He stated that tuberculosis in his herds had spread rapidly. After the first tuberculin test 17% of his cattle were condemned. doubtlessly a high percentage and a great loss. But, he claimed, in the last year only 1% had to be destroyed. The decrease of the disease was thus proved, but as stated before, this method is very expensive and not practicable for every one.

Koch's tuberculin failed to give any satisfaction, when using it for diagnostical purposes. Slightly affected animals often reacted very readily, and highly affected ones hardly showed any reaction.

At that time von Heyden, secretary of agriculture, rejected the above-stated proposition on account of the difficulty in diagnosing tuberculosis in live stock.

Later on, the examination of the herdbooks of different estates in Pommerania and West-Prussia, by Prof. Ostertag, led to the following preliminary proposals by the department of health:

"Animals afflicted with, so-called, open tuberculosis (that is the advanced stage of pulmonary tuberculosis, especially tuberculosis of the udder, intestines, and genital organs) should be ascertained and a revision of stables ordered. Infected or doubtful animals should be destroyed and the owners indemnified."

That there is a great deal of good in these propositions can not be denied. For instance the authorities were empowered to destroy all animals that showed evidence of tuberculosis, especially tuberculosis of the udder. The small dairymen were of course not benefited by such methods.

Now, all other methods, to suppress tuberculosis of cattle, have been surpassed by that of Prof. von Behring. The easiness of application and its comparative cheapness cannot be questioned, and a plan must be formed, which will enable us to absolutely suppress tuberculosis in our cattle herds within not too long a time. There was but little hope to suppress tuberculosis. The duration of the disease, as well as the length of time before affected animals showed any symptoms of it, made it almost impossible to separate the healthy from the infected cattle. But it seems, that Prof. von Behring has now solved the problem. Already in December, 1901, at Stockholm, Prof. von Behring refuted Prof. Koch's doubts, as to the identity of tubercle bacillus in man and cattle, with the assertion that he succeeded in immunizing cattle against tuberculosis with tubercle cultures from human beings. His first publication regarding his method appeared in No. 5 of "Beiträge Zur Experimentellen Therapie," May, 1892. In the summer of that year he held a course at his institute at Marburg, in which a number of veterinarians participated, among others County Veterinarian Schmidt of Giessen, Hessia. The Hessian Government authorized the latter to test Prof. von Behring's method at an estate in the neighborhood of Grünberg. Since then, the young cattle are immunized on this estate.

In order to prove the success of his method of immunization, he requested Dr. Eber (Leipzig), Dr. Schlegel (Freiburg, i. B.), and myself to aid him in these experiments. For this purpose Prof. von Behring gave each of the above-named gentlemen two immunized animals; one of them immunized with human culture and the other with a culture of cattle tuberculosis. The experiments were begun in April, 1902. One of the heifers was a "Simmenthaler," and the other a "Vogelsberger." After they had become somewhat accustomed to the stable, we procured a third animal for control. The tuberculin test was made on this at once, and showed no reaction whatever. Then the first infection was made, consisting of 0.15 tubercular matter from a freshly slaughtered cow, in a physiological salt solution. This tubercular matter apparently consisted of newly formed grayish-red nodules with a little caseous matter. Bacilli were plentiful. The three animals were injected at the same time and with the same quantity. The first few days nothing exceptional was noted, excepting of course a little swelling at the point of injection. There was no rise in temperature. While the swelling in both immunized animals disappeared gradually, that of the control animal began to grow after the tenth day. The animal began to lick the swelling, which showed that it was either itching, or painful. From time to time an increase in temperature was noticed. The animal coughed repeatedly. The lymphatics on the inside of the left foreleg showed a slight swelling. Two weeks later the three animals were tested with tuberculin. The results were:

Simmenthaler (von Behring's method), no reaction.

Vogelsberger (immunized with cattle tuberculosis), 104°F.

Control animal (not immunized), 106 3-5°F.

Here I wish to draw your attention to a symptom which Prof. von Behring has also constantly observed, *i. c.*, animals immunized with a culture of cattle tuberculosis always show a sensitiveness towards tuberculin, while this is *not* the case with animals treated according to von Behring's method.

After three weeks the control heifer was killed. Post-mortem examination revealed the following:

"Swelling at point of injection of about the thickness of a thumb and 6 cm. long. The prescapular and axillary glands also swollen. In all these affected parts, was to be seen deep yellowish tubercle matter so commonly found in all affected organs; calcifications were also present—*a condition of the utmost importance in order to prove the age of tubercular processes in cattle.* Tubercular changes were also noticed in the lungs, bronchii and mediastinal glands. The presence of tubercular bacilli was demonstrated by the aid of the microscope. Hereupon a second control heifer had to undergo the tuberculin test—also without reaction. This animal was treated after Prof. von Behring's method. Course and symptoms, as well as the tuberculin test made after two weeks, gave the same results, as the first experiment, only somewhat less intensive with the second control heifer than with the first. After three weeks this control animal was also killed. Postmortem: Point of injection and prescapular lymphatics showed tubercular changes, but no pulmonary tuberculosis. In this case the deep yellow caseous matter was not present in the tubercular growths; they had a rather light grayish appearance, but no calcifications. The cause of this may be that a pure culture of cattle tuberculosis had been used, while for the first test a tubercle material was injected which led to a mixed infection. These control experiments will be finished after Dr. von Behring's immunized cattle have been killed and thoroughly examined. As for the external examination of these animals, we have only positive results.

1. Animals did not react after injection.
2. They have always had a good appetite and at no time showed symptoms of the disease.
3. Their weight was ascertained every two weeks, which showed a steady increase, in accordance with the quantity of food they had been given.

In August I sent the control cattle back to Prof. von Behring, as one of the animals (Vogelsberger) was pregnant and Prof. von Behring intended to examine her milk.

From Prof. von Behring's publication in "Beiträge Zur Experimentellen Therapie," as well as from his lecture at Kassel, and especially from repeated private remarks, furthermore by studying the data of his experiments, I learned that his tests dated back quite a number of years and that positive results had always been obtained. Similar results were also shown by a number of experiments in practice.

1. 100 heads of heifers were vaccinated at an estate in Mecklenburg Strelitz (Gören).
2. 100 heads of cattle at the estate Sarvar (Hungary), belonging to Prince Ludwig of Bavaria.
3. At the estate Wolfshagen (Mecklenburg Strelitz) 60, and at a nearby estate 30 heads of cattle.

The cattle of these estates, with the exception of the last mentioned, were highly tubercular. But every one of the vaccinated animals that has been slaughtered so far, upon examination proved to be perfectly free from tuberculosis.

On account of these results, I am perfectly convinced that we have here a method which will lead to success and will be of immense value in suppressing cattle tuberculosis; and that as to cheapness and easiness of application it surpasses and supersedes all other methods so far known.

Dr. von Behring lately advises to vaccinate only young cattle at the age of from three weeks to four months, while so far also animals up to two years and older have undergone the treatment. According to recent information, however, I find that animals older than four months are not entirely excluded. However, in older animals positive results cannot be guaranteed.

Tubercular animals will show after vaccination the same reaction as if treated with tuberculin, but more intensive. The treatment is by no means dangerous, but results are doubtful.

Old animals should not be vaccinated in herds where tuberculosis is prevalent. But if circumstances should make this desirable, they should, prior to the vaccination, be carefully tested with tuberculin and only such animals should be vaccinated which show *no* reaction.

Calves from three weeks to four months may be vaccinated without previous tuberculin test, even if they belong to a tubercular herd.

Our first duty now is to convince the public, and especially the representatives of agriculture, of the immense value of this method. This cannot be attained quickly, as circumstances are unfavorable. It is very difficult to keep track of a great many of the vaccinated animals. Of course, some of them will be used for breeding purposes, others will be sold and lost sight of. It will, therefore, be possible only in a very few cases to follow up our vaccinations, and it will take years before we have been able to examine a certain number of immunized animals at the slaughtering houses. The only way to reach our purpose would be to try to have breeders of cattle come to an understanding with dairymen to gradually substitute their milk cows by immunized stock. If we succeed in this, we shall, in a few years, be able to keep records which will afford an accurate estimation as to the value of the method. Each animal would be registered as to breed, date of birth, date of first and second vaccination, amount of milk, and lastly, the post-mortem examination after slaughtering the animal. If we begin now, it will take three years to get such a stock. Then it will again take two years until a certain amount of immunized cattle can be killed and examined. So that it will take about five years until we can be sure of success and then only is there a prospect of having this method enforced by law.

To get a stock of immune cattle within a shorter time, it would be advisable, especially for dairies, to vaccinate animals up to two years of age. As stated before, this can be done with

precaution, and an accurate selection of animals which have shown no reaction after a severe tuberculin test. But as this would be rather expensive (because of the destruction of all infected animals), only large dairies could afford to adopt this method.

I would propose to vaccinate four times a year. This would make all other precautions, as disinfection of stables and isolation of infected animals unnecessary, for *immunized cattle may be left among infected animals without hesitation; indeed, as von Behring claims, their natural immunity is even strengthened through the contact with infected animals.*

The profit derived from vaccination would surely outweigh the expenses. The cattlemen would not be compelled to destroy any more animals. Immune cattle thrive better even on less food than infected ones. The production of milk and meat would increase. Insurance of said animals would be but a minimal expense. *Our farmers would be freed from a burden that has hitherto rested heavily upon them.* Man also would be released from a danger, whose greatness we are hardly able to realize. Prof. Koch stated at the time: *"The consumption of tubercular milk and meat is a danger to human beings, which, be it great or small, should be removed."* You are aware of the fact that Koch has changed his views. You also know that the meat inspection law is based upon his latest opinion. But you do not know whether this basis will not break down some day, and humanity demand the removal of the existing danger. I cite here the remark of von Behring, made at Kassel: *"The main source of the development of tuberculosis is the milk consumed by infants."* This opinion will be refuted by many, since it appears to be in contradiction to the tuberculosis statistics in the different ages of man, also quoted by von Behring. We find here that during the first year of life, tuberculosis is very scarce, then gradually increases and often exists until senile age is reached. If, then, von Behring's assertion is correct, the disease must be latent for years in the human body, at least to the perception of

the diagnostic. But is not this possible? Prof. von Behring proved that the mucous membranes of the intestines, the cells of which are not quite united in infancy, afford the bacilli entrance into the system. Dr. von Behring has so far not expressed an opinion as to how these bacilli keep themselves dormant in the system. At this occasion, however, I would like to draw your attention to something which is well able to support von Behring's theory, namely, the frequent failure of Bang's method of suppressing tuberculosis. The experience was, that when non-reacting animals were strictly isolated and did not come in contact with the reacting ones, some of the former would react after the next test. Bang has already demanded the isolation of the calves from the mother animals and their feeding with sterilized milk. There are but two explanations for the recurrence of tuberculosis in herds where strict isolation is practiced and sanitary precautions are taken. Either the disease has been latent in the single animals and developed gradually, or in spite of isolation new infection has taken place. If the latter was the case, then all animals and human beings ought to be affected. But since this is not so, we are compelled to doubt this theory. In man we find a similar occurrence that speaks for latent tuberculosis. As already mentioned, deaths from tuberculosis are very rare during infancy; they increase gradually and reach their highest percentages in the period of puberty. Why the danger of infection should be greater in this period, cannot be explained.

As you see, there are still a number of dark points in the doctrine of tuberculosis upon which light may be thrown some day. Let us hope that all these problems will be solved at some future time for the benefit of humanity. Let it now be our first duty to test Prof. von Behring's method in practice. Should I have been successful in impressing upon your minds the importance of aiding us in this work, then the purpose of this lecture has been attained.—(Extract from *Berliner Tierärztliche Wochenschrift, 1903, No. 48.*)

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Professor E. von Behring Dr. C. Siebert

The Celebrated Marburg Institute for Research against Infectious Diseases.

EXTRACT FROM A LECTURE

ON

Extermination of Tuberculosis

PRESERVATION OF MILK AND RAISING OF CALVES

BY

PROF. E. von BEHRING

(Marburg).

(Delivered March 16th, 1904 at the Agricultural Exhibition at Bonn)

N 3

I PRESUME it is generally known that I have succeeded in discovering means by which we are able to immunize cattle and protect them against tuberculosis, just as human beings are guarded against smallpox by vaccination.

My prevention against tuberculosis, as well as Jenner's preventative against smallpox consists of live bacilli.

Please do not entertain the erroneous opinion that my immunizing substance has the same effect, as tuberculin; tuberculin is of value for the diagnosis of tuberculosis in cattle, while my immunizing substance is *a preventative for tuberculosis in cattle.*

I have been greatly assisted in my endeavors to suppress tuberculosis by agriculturists in general among others, especially by Count Zedlitz. It was he, who practically cleared the road for me in Hesse-Nassau, and enabled me to practice my method. The statistics of my tests reveal a very remarkable fact, namely, that in large stables, holding 40 to 50 heads of cattle, most of the animals reacted to the test, whilst in stables with 2 to 4 animals 3 to 4% were infected, and I found that this condition prevailed everywhere.

The first practical applications of my method were made in three counties in Hesse-Nassau and in this step Count Zedlitz has aided me very much. Later on, estate owners in Hessia, South Germany, Mecklenburg, Hungary, Bohemia, Silesia, gladly had their herds immunized and even had control tables issued of each immunized animal.

Practical experiments with my preventative were made also at the Hungarian estates of Prince Ludwig, of Bavaria. Count Schwerin Cöhren, Count Wolfshagen, as well as Mr. Shelings in Mecklenburg, Messrs. Bolle, father and son, Mr. von Walchern and Mr. Rosler in Teschen, etc., etc.

The stability of our immunizing substance is such that we are enabled to send it, even to very far countries, without fear of deterioration. Dr. Lorenz, the celebrated veterinarian, in his paper on my immunizing substance states: "After all that I have seen so far, I am sure that here we have a method which insures success. This method is of immense value and surpasses all others as to cheapness and easiness of application. It will supersede all previously proposed methods and render them absolutely superfluous."

This immunizing method became a law in Hessia, Oldenburg, Mecklenburg and the Kingdom of Saxony.

It is needless to mention that the successful suppression of cattle tuberculosis is of vast importance in the breeding of cattle. It would release agriculturists from a burden which has hitherto rested heavily upon them. In the German Empire the loss amounts to millions yearly.

We must also take in consideration and calculate the loss in the production of milk, insufficient assimilation of food, and the lower percentage of nutrient substance contained in this milk, and last, but not least I would mention the threatening of wasting diseases and death to humanity.

You are aware that milk of tuberculous cattle contains tubercle bacilli; if this milk is fed to calves, they certainly will be infected,

and while the animals may have a healthy appearance to the end of their lives—if you make the tuberculin test on animals, about 3 years old, of such a herd, you will hardly find one among them, that does not react. Many of the older animals begin to cough, develop tuberculosis of the udder, of the kidneys, of the genital organs, etc., etc.

The animals with, so-called, open tuberculosis are the principal cause of spreading the disease since they distribute the germs all over the stable. We can diminish the danger of infection of newly-born calves to a certain extent, but we cannot abolish it, as the virus of the stable is liable to be sucked up by the calf and other possibilities of infection exist in tubercular stables. I merely wish to remind you of the fact that the virus of animals with open tuberculosis may find its way into the food, germs may also be transferred from one animal to the other through the air, if, for instance, two animals, of which one is coughing, stand facing each other. But I consider that the greatest danger of infection is in the feeding of tubercular milk to calves in the earlier stages of life. Young calves, infected in this manner, later on develop the disease in consequence of the germs contained in the air they inhale.

We know from experience that if sterilized milk is fed to the calves, it is apt to produce diarrhœa and thus favor the occurrences of infectious processes, and that it is anything but a preventative in dysentery in calves.

A common-sense hygiene is exercised regarding our drinking water, from its place of origin, to that of its consumption, and should the slightest possibility of infection arise, the water supply

would be at once cut off. Should not the same precaution be taken in regard to the milk? I am about to remove the danger of infection from tubercular milk through introduction of cattle immunization.

The simplest, most natural and cheapest substitute for mother-milk will always be fresh and sweet cow's milk, but we must insist upon one demand—namely that the fresh milk is free from tubercle bacilli, or other generators of disease. This demand can be satisfied by dairies with stables free from tuberculosis.

The following citations from communications concerning my immunizing method to prevent tuberculosis are of interest:

1. "Calves which had been inoculated in Spring, 1903, an autopsy of five animals showed them entirely free from tuberculosis, while prior to the introduction of the method tubercular changes had invariably been noticed upon investigation of the slaughtered calves. All immunized calves enjoy the best of health."

2. The following from Count Schwerin—Wolfshagen, dated February 7th, this year: "A year has now elapsed since the first animals were immunized. We carefully examined all animals here and in Schlepkow, and I am very pleased to state that all animals enjoy the best of health. I must here express to you and Mr. Ebeling my sincere thanks, as you saved this stock from sure death. The immunized yearlings here and in Schlepkow have a much better appearance than the stock in Hornshagen, which have not been immunized. I have not heard the animals cough during the whole year, and all immunized animals are neither tuberculous nor do they possess any pre-

disposition toward tuberculosis. I am now having the stock in Hornshagen immunized by Mr. Ebeling."

3. "The feeding experiments with milk from immunized cows are already being made. Last week a half-year-old heifer had to be killed, because of a broken leg. Very thorough microscopic examination revealed neither tubercular changes, nor tubercle bacilli, although the animal had been kept with a highly infected herd."

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